

# Claims

- [c1] A simulation system for simulating an operation of an automotive vehicle comprising:
- an input providing vehicle information and path information; and
  - a controller coupled to the input, said controller having a vehicle computer model therein, said controller programmed to,
    - determine an initial steering wheel angle input to the computer model;
    - determine a first steering wheel angle input to the computer model at a time later than the initial steering wheel angle input by comparing a look ahead point and an intended path;
    - when the vehicle model is understeering, operate the computer model with the initial steering wheel angle input until an error of the first steering wheel angle and the initial steering wheel angle is decreasing;
    - when the error decreases, operate the computer model with the first steering wheel angle input; and
    - generate an output in response to the vehicle model and the initial steering wheel input or the first steering wheel input.

- [c2] A system as recited in claim 1 wherein the controller controls an output device in response to the vehicle model and the initial steering wheel input or the first steering wheel input.
- [c3] A system as recited in claim 1 wherein the computer model comprises a dynamic control model.
- [c4] A system as recited in claim 1 wherein said controller determines when the vehicle model is understeering in response to a yaw acceleration.
- [c5] A system as recited in claim 1 wherein said controller determines when the vehicle model is understeering in response to a yaw acceleration and an increasing steering wheel angle.
- [c6] A system as recited in claim 1 wherein said controller determines when the vehicle model is understeering in response to a yaw acceleration greater than a threshold and an increasing steering wheel angle.
- [c7] A system as recited in claim 6 wherein said controller determines an increasing steering wheel angle by comparing the initial steering wheel angle input to the first steering wheel angle input.
- [c8] A system as recited in claim 1 wherein said controller

determines the error in response to a decreasing steering wheel angle.

- [c9] A system as recited in claim 1 wherein said controller determines the error in response to a decreasing steering wheel angle and the previous steering wheel angle and the first steering wheel angle input.
- [c10] A system as recited in claim 1 wherein said controller determines the error in response to a decreasing steering wheel angle and a difference of the previous steering wheel angle and the first steering wheel angle input.
- [c11] A system as recited in claim 1 wherein said controller determines the error in response to a decreasing steering wheel angle and a difference of the previous steering wheel angle and the first steering wheel angle input compared to a threshold.
- [c12] A method of operating a vehicle computer model having vehicle information and path information therein comprising:
  - determining an initial steering wheel angle input to the compute model;
  - determining a first steering wheel angle input to the computer model at a time later than the initial steering wheel angle input by comparing a look ahead point and

an intended path;

when the vehicle model is understeering, operating the computer model with the initial steering wheel angle input until an error of the first steering wheel angle and the initial is decreasing; and

when the error decreases, operating the computer model with the first steering wheel angle input.

[c13] A method as recited in claim 12 further comprising determining when the vehicle model is understeering in response to a yaw acceleration.

[c14] A method as recited in claim 12 further comprising determining when the vehicle model is understeering in response to a yaw acceleration and an increasing steering wheel angle.

[c15] A method as recited in claim 12 further comprising determining when the vehicle model is understeering in response to a yaw acceleration greater than a threshold and an increasing steering wheel angle.

[c16] A method as recited in claim 15 wherein an increasing steering wheel angle is determined by comparing the initial steering wheel angle input to the first steering wheel angle input.

[c17] A method as recited in claim 12 further comprising de-

terminating the error in response to a decreasing steering wheel angle.

[c18] A method as recited in claim 12 further comprising determining the error in response to a decreasing steering wheel angle and the previous steering wheel angle and the first steering wheel angle input.

[c19] A method as recited in claim 12 further comprising determining the error in response to a decreasing steering wheel angle and a difference of the previous steering wheel angle and the first steering wheel angle input.

[c20] A method as recited in claim 12 further comprising determining the error in response to a decreasing steering wheel angle and a difference of the previous steering wheel angle and the first steering wheel angle input compared to a threshold.

[c21] A method of operating a vehicle computer model having vehicle information and path information therein comprising:  
determining a plurality of current steering wheel angle inputs to the computer model by comparing a look ahead point and an intended path at various times;  
determining when the vehicle model is understeering in response to a yaw acceleration;

when the vehicle model is understeering, holding the steering wheel angle to a first steering wheel angle input of the plurality of current steering wheel angles until an error determined as a function of the plurality of steering wheel angle inputs is decreasing;

when the error decreases, operating the computer model with the one of the plurality of current steering wheel angle inputs subsequent to the first steering wheel angle input.

[c22] A method as recited in claim 21 wherein determining a plurality of current steering wheel angle inputs comprises periodically determining the plurality of current steering wheel angle inputs.

[c23] A method as recited in claim 21 wherein the yaw acceleration comprises a normalized yaw acceleration.

[c24] A method as recited in claim 21 wherein the normalized yaw acceleration comprises a steering wheel angle normalized yaw acceleration.

[c25] A method as recited in claim 21 wherein operating the computer model with the one of the plurality of current steering wheel angle inputs subsequent to the first steering wheel angle input comprises operating the computer model with the one of the plurality of current

steering wheel angle inputs subsequent to the first steering wheel angle input that corresponds in time to a decreased error.

[c26] A method as recited in claim 21 further comprising determining the error in response to a decreasing steering wheel angle.

[c27] A method as recited in claim 21 further comprising determining the error in response to a decreasing steering wheel angle and the previous steering wheel angle and the first steering wheel angle input.

[c28] A method as recited in claim 21 further comprising determining the error in response to a decreasing steering wheel angle and a difference of the previous steering wheel angle and the first steering wheel angle input.

[c29] A method as recited in claim 21 further comprising determining the error in response to a decreasing steering wheel angle and a difference of the previous steering wheel angle and the first steering wheel angle input compared to a threshold.